AGRICULTURAL NEWS LETTER

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This publication gives information on new developments of interest to agriculture on laboratory and field investigations of the du Pont Company and its subsidiary companies.

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Agricultural News Letter (du Pont)
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THE INSECT MENACE AND THE ROLE OF CHEMISTRY IN COMBATING IT DISCUSSED BY AN AUTHORITY

EDITOR'S NOTE:- Many readers will find useful for the information contained and for reference this paper by Dr. McDonnell, President of the Association of Official Agricultural Chemists. It was presented at the last meeting of the Association in November, 1937. Due to space limitations, the paper has been divided into two parts. The second part will appear in our November number.

By C. C. McDonnell,
United States Food and Drug Administration,
Washington, D. C.

An unwritten law of this Association apparently demands that the incoming president shall make an address. This is indicated by the past history of the Association and quite forcibly by the fact that provision is made for it on the program without consulting this official. Fortunately for him, however, the subject upon which he may speak before the Association is left to his own choosing, and in reviewing the addresses of former presidents I find that they have covered a wide range of topics. I regret that I am not in a position, as has been the case with many of my predecessors in this office, to present to you a paper embodying the results of research in a field relating closely to this Association's work, but being engaged in regulatory work and having no opportunity for fundamental research I shall speak on a subject of a more general character. Since the problem of insect control is a live one at the present time I have selected as my subject, "The Insect Menace and The Role of Chemistry in Combating It."

The history of insect life reads like a romance. It has been estimated that many species existed in a high state of development as long ago as one hundred million years or more and, as indicated by fossil remains that have been discovered, have not changed so far as it can be determined during that time. Many fossil remains of roaches, apparently the same as those we have today, have been found in coal deposits, showing that they existed in great numbers during the carboniferous era. Hence, if we consider that the age of man is less than one million years (as has been estimated by paleontologists), and if, in addition, it is realized that there are one hundred or more generations in the life of the insect to one of man, we see what a tremendous advantage the insects have had in adapting themselves to life on the earth. They possess characteristics that man does not possess and cannot acquire, such as the ready adaptation to environment; rapidity of multiplication (no methods of

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birth control practised); short period of infancy; power of flight in many species; power of concealment due to their small size and color adaptability; protection afforded by hibernation; superior methods of defense,- many species being protected by a defensive armor and other anatomical advantages; feeding habits; etc. There is no "old age" with insects,-when their work is done they die.

Insects Show High Degree of Intelligence

The opinion generally held that in our fight against insects we are pitted against creatures of low intelligence is far from correct. Nowhere in the animal kingdom does the self-sacrificing cooperation of its individuals exist to the degree that it does in the more highly developed species of insects, such as the ants and the honey-bees. As expressed by some writers they enjoy what, to us, may be considered as only a "social ideal." Take, for example, the ants. The mother ant or queen lives under the protection of the home, usually underground, which she never leaves, is fed and cared for by the workers,-once fertilized always fertilized,- and her only function seems to be to lay eggs, which in some species may be at the rate of many thousands a day. These, and the young when hatched, are cared for by others of the colony.

Another class of insects that possesses remarkable properties of adaptation to environmental conditions is the aphids. Some species undergo a complete change in their method of reproduction according to the weather. For example, during the summer months they give birth to living young, producing several generations, the number depending upon the length of the season. With the exception of the last generation in the fall all of these are fertile females, some winged and some wingless, and they in turn also produce living young females. With the approach of cold weather both males and females are produced. The females of this generation deposit eggs on the branches and twigs; the eggs remain over until spring when they hatch, and again all the young are fertile females.

Insect Scourges an Age-Old Problem

According to the many accounts of insect scourges that are reported in early writings, insect pests have harassed man in all ages. Notwithstanding such knowledge, there has until more recent years been a tendency, particularly on the part of the general public, to ignore or to look with indifference upon the insect menace. This has been due in part, no doubt, to the fact that the term "bug" carries with it a contemptuous significance. The entomologist of earlier days was frequently subjected to derision, being called "The Bug Catcher" and pictured as an unattractive, bewhiskered individual chasing butterflies with a net attached to a pole. Even the eminent Dr. Howard has stated in his writings that he felt keenly in his younger days the ridicule that was heaped upon the "bug catcher." Yet he recognized the great economic importance of the insect problem and dedicated his life to the work, becoming one of the world's leading authorities on entomology. As stated by Dr. A. F. Woods in an address on his life and work, "Dr. Howard is credited more than any other one man with awakening the United States to the peril of insect pests. He has dramatized man's struggle against harmful insects as a war without quarter for possession of the world's food supply."

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Losses Cannot be Accurately Expressed

It is not possible to express accurately in dollars the loss to our agricultural industry due to insects, owing to the many factors that enter into the making of such an estimate. In fact a reduced crop may mean a higher return to the grower due to a higher unit price, but it means a lower profit to the railroads or other carriers and to the distributors, and an increased cost to the consumer. Dr. Howard has stated that insects destroy ten per cent of our crops before they are harvested and that the damage to stored grain and milled products represents a loss of five per cent of their total value. He has also stated that insect ravages nullify the labor of 1,000,000 men annually. Another writer estimates that the economic loss to farmers of the United States due to insects is greater than the cost of educating our children. To this should be added the damage to forests and forest products, to our clothing and our furniture, to the livestock industry, and to man himself through diseases that are insect-borne,-to say nothing of the great annoyance to his comfort. I have not considered in this paper the problem of plant diseases caused by fungi and bacteria, the losses from which are next in importance to the losses caused by insects.

Insect Menace is Increasing

As late as 1931 Dr. Howard stated that the insect menace is increasing under present conditions and the noted Belgian scientist and author, Maeterlinck, stated in his writings that one day insects would be the successors of mankind upon the earth. The famous surgeon, Dr. William Mayo, said in an address delivered before the meeting of The American Chemical Society in St. Louis in 1928, "The easily recognized and obvious enemies of man,-beasts and serpents, storms and earthquakes,-are not numerous, but his less conspicuous and his microscopic enemies exist by the millions. The fight between man and parasites is a battle to the death for food, because insects, protozoa, and bacteria have essentially the same food necessity and were at home on the globe millions of years before man." Dr. Mohler, Chief of the Bureau of Animal Industry, stated before the Agricultural Committee of the House of Representatives that unless a comprehensive control program is inaugurated the future food supply of the country may be seriously menaced.

We often hear older people say, "Why is it the insect problem is so much more serious now than when I was a boy? We did not hear so much about it then." As a matter of fact, insects are much more numerous in this country and do infinitely more damage now than when some of us were lads. This is due to a number of causes. Man has created conditions peculiarly favorable to their distribution and increase. Every advance that speeds transportation, whether by air, land, or water, lends aid for the spread of these pests from one region to another, and the intensive culture that accompanies civilization furnishes them with an abundance of food and encourages their multiplication. The majority of our most destructive insect pests in this country are of foreign origin, and many of them have appeared during this generation. The gypsy moth came from Europe, as did also probably the codling moth; the brown-tail moth from Holland; the cotton boll weevil from Mexico in 1893; the Japanese beetle, as the name indicates, from Japan in 1916; and the corn-borer from Hungary. The Colorado potato beetle did not occur in the eastern part of the United States

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until about 1875; the San Jose scale appeared in the nineties; and the Mexican bean beetle, which is by far the most serious insect enemy of beans, was not known east of the Mississippi River until 1920. It now infests most of the bean-growing areas throughout the United States.

As stated by Dr. Howard in 1931, "We are awakening from our apathy concerning the insect menace." The fact that we are becoming insect conscious is impressed upon us continuously in our daily reading matter. Over five thousand papers and books on entomological subjects are published annually and, in addition, innumerable articles appear daily in our newspapers and magazines. It is also manifest in our music. At the recent meeting of The American Chemical Society held at Rochester, New York (the second largest meeting in the history of the Society), the musical program given by the orchestra preceding the president's address included "The Flight of The Bumble Bee," "Mosquito Dance," "The Bee," and selections from "Fire-Fly."

Visitations from Providence

In the earlier days insect plagues were looked upon as visitations from Providence, and days of prayer were set aside by church and state officials to call on God to allay the ravages of insects. In the spring of 1848 hordes of crickets attacked the crops in the field near Salt Lake City where the Mormons had recently established a colony. The people assembled around their fields and prayed, and almost immediately, it is recorded, thousands of sea gulls swarmed overhead, alighted in the fields, and devoured the crickets, thus saving the greater part of the crops. The grateful Mormons erected a monument to the sea gull, which stands just outside the gates of the Temple in Salt Lake City. As late as 1875 the Governor of Missouri appointed a day for fasting and prayer on account of the ravages in that state of the Rocky Mountain locust.

It is impossible to tell when the fight against insects was begun, but it is probable that control methods were first directed against those that pestered man himself. A professor in one of our leading universities has stated that extended researches have developed the fact that man took to the wearing of clothes for the purpose of protecting himself from annoyance by insects. Methods for destroying insects attacking vegetation were started, no doubt, soon after the cultivation of plants began to attract serious attention. In his writings in the first century, Pliny speaks of mildew as "that greatest curse of all corn" and states that "if branches of laurel are fixed in the ground it will pass away from the field into the leaves of the laurel." He refers to insect pests attacking grain and recommends steeping the seed in wine or mixing bruised cypress leaves with it. Pliny also quoted Democritus, who lived between 400 and 300 B.C., as recommending "sprinkling the plants with Amurca of olives without salt to prevent the blight from attacking them and to destroy worms adhering to the roots." Another method recommended was to carry a bramble frog at night around the field and then bury it in an earthen vessel in the middle of the field. Later various applications to the plants were recommended, but the materials suggested as being most effective were generally those having the vilest smell or most offensive taste.

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The next step in control methods was by the use of chemicals. Sulfur, which was known to the ancients, was one of the first to be recommended. Cato, writing about 200 B.C., states that "one method of destroying the 'vine fretter' was to fumigate the trees with smoke from a mixture of Amurca of olives, sulfur and bitumen for three days in succession." References to the use of arsenic as an insecticide are also found in very early writings. Pliny suggests that if the fruit is falling from the vines, or the grapes rotting, they should be sprinkled with sanderach (a natural arsenic sulfide).

Early Uses of Insecticides

Several of our other present-day insecticides were used in some form more than a hundred years ago. Tobacco dust was recommended in France for use against plant lice in 1763. Pyrethrum powder has been in use for more than one hundred years. Arsenic and honey mixture for ants was recommended about 200 years ago. Marco Polo, in his writings at the end of the 13th century, mentions the use of crude mineral oil for anointing camels that have the mange. Peter Kalm, a Swedish scientist who visited this country in 1748-1749, in his book, "Travels in North America," refers to the insect pests he encountered and the remedies used by the people here to combat them. Among the materials mentioned are a decoction of "white mullein," to be applied to the wounds of cattle infested with worms; burning sulfur for bedbugs; an extract of hellebore root to be used when the children "are plagued with vermin"; and shavings and chips of red cedar distributed in clothing to protect it against being worm eaten. He states also that bureaus and chests made of red cedar are used for the same purpose, but adds, "It is only useful for this purpose as long as it is fresh."

But little progress in the methods for the destruction of harmful insects was made in this country until about 1860, when the currant worm had been introduced into the Eastern States and the Colorado potato beetle into the Western. Between 1860 and 1870 Paris green, which was being used as a paint pigment and therefore was readily available, was tried against the potato beetle. The results were so satisfactory that for many years it was the standard treatment for potatoes to control this pest, and it is still used to the extent of four to five million pounds annually for this purpose and for other garden crops. However, it was nearly 30 years later before organized investigations were directed toward the development of more effective means of insect control and better insecticides. With the growing diversity of our population and the introduction of new pests the problem became more urgent.

After the passage of the Hatch Act in 1887 and the establishment of the State Agricultural Experiment Stations great impetus was given to the use of insecticides. The Federal Government had already appointed entomologists, who were actively engaged in the study of control methods, but it was not until 1896 that it recognized the important role chemistry was to play in this problem and appointed a chemist to work in this field, the late Dr. J. K. Haywood, who became Chairman of The Insecticide and Fungicide Board soon after the passage of the Insecticide Act and the 34th President of this Association. Dr. Haywood, working under Dr. Wiley in the then Bureau of Chemistry, was a pioneer and leader in this field, a man of whom our Secretary, Dr. Skinner, in a biographical sketch of his life and work published in the Journal of this Association, wrote "It may be said that he and his colleagues working in the Association of Official Agricultural Chemists created an insecticide chemistry."

(Concluded in November Number)

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SCAB OF WHEAT AND BARLEY INVESTIGATED AND CONTROL METHODS DEVELOPED BY THE DEPARTMENT OF AGRICULTURE

EDITOR'S NOTE:- Typical of the valuable work done by the United States Department of Agriculture is that in connection with control of scab of wheat and barley. The information given here is from Farmers' Bulletin No. 1599. It is suggested that those interested obtain a complete copy of this bulletin.

By James G. Dickson, U. S. Department of Agriculture, and Wisconsin Agricultural Experiment Station; and E. B. Mains, U. S. Department of Agriculture, and Purdue University Agricultural Experiment Station.

Scab, or Fusarium blight, is a disease of wheat, barley, rye, and oats caused chiefly by a minute fungous parasite known by the Latin name Gibberella saubinetii (Mont.) Sacc. In 1919 it was estimated that losses of spring and winter wheat alone, caused by this disease, amounted to about 80,000,000 bushels. In 1928 the disease was destructive again, particularly to spring wheat and spring barley.

The disease attacks not only the heads of small grains but also the seedlings. It attacks the seedlings of corn and also the stalks and ears. The fungus lives over winter abundantly in diseased cornstalks and also on old diseased straw and stubble or small grains.

Losses from scab on small grains depend chiefly on (1) relative abundance of the fungous parasite on old crop refuse, such as cornstalks, straw, and stubble, in the fields, and (2) weather conditions during or shortly after the blossoming period of the grain.

The disease appears during humid summers on barley, wheat, rye, and oats sown on poorly prepared cornland or wheatland. Where severe losses from scab have occurred, they have always been associated with fields where cornstalks, wheat straw, or similar crop refuse had been left partly turned under or on the surface of the field. For example, during 1928 the barley growers in southern Wisconsin who sowed barley on poorly plowed cornland suffered an average loss of about 17 per cent of their crop. In contrast, the farmers who sowed barley on cornland from which the corn was removed and the stubble completely plowed under sustained less than 2 per cent loss from scab. In other words, care in preparing the soil alone netted these growers a saving of 15 per cent of their crop. In fact, the scab disease was destructive in Wisconsin during 1928 only

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where barley or wheat was sown on poorly plowed or disked cornland. In Iowa, Illinois, and Indiana the saving by sowing small grains on clean land was even greater, frequently meaning the difference between success and failure, especially with barley. The scab disease and the European corn borer are both most effectually controlled by the complete plowing under of cornstalks.

Description of the Disease

On small grains the scab disease develops on the heads during and following blossoming and also occurs on the grain seedlings as a seedling blight.

The head blight or scab becomes evident during the period from flowering to the maturation of the crop. The symptoms of the disease are similar, in general, on all of the grains. Some or all of the spikelets lose their green color, die, and turn straw colored. Barley kernels frequently turn brown, especially toward the base of the infected spikelets. A salmon-pink or reddish-colored fluffy, dustlike mycelium frequently is evident along the edge of the hulls or chaff and at the base of the spikelets. The extent of the spread of the disease in the head depends largely upon climatic conditions. During continued wet weather early in the blossoming period the entire head is overrun by the scab fungus, and the kernels are invaded and shrunken or destroyed. Under climatic conditions less favorable for the development of the disease, only a portion of the head or even a single spikelet may be affected.

The scabbed kernels are badly shrunken and are conspicuous by their changed surface texture and color. In wheat the scabbed grains are wrinkled and have a rough, flaky, or scabby surface, and a pale-gray or whitish to salmon-pink or reddish color. In rye the manifestations of the disease are similar to those in wheat, except that the slightly infected rye kernels are dark brown and the badly scabbed kernels are carmine red.

Less Evident in Barley and Oats

In barley and oats the disease is much less conspicuous, since the hulls cover the kernel. The infected barley hulls usually darken to light brown, especially near their bases, and have the characteristic dusty-gray color, especially on the faces of the kernels. The badly scabbed kernels are shrunken and frequently overrun by the red coating of mycelium or the scattered masses of round, black winter-spore cases. In many instances of late infection the hulls show only the darkened basal discoloration and the roughened texture and gray color on the face of the grain. The kernels within, however, show the grayish, scabby, and shriveled condition characteristic of the disease. The hulls of the infected oat kernels are a dirty-grayish color, roughened, and frequently covered in part by the deep carmine-red mycelium or black winter-spore cases. The infected hulls are not darkened as in barley. The oat kernels within the hulls also have the light, shriveled, scabby appearance characteristic of the disease on barley.

The scabbed, threshed grain can be detected in most cases by the presence of an occasional or many discolored kernels. The grain carrying a high percentage of

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infection is of light weight per bushel, is off color, and has few or many pink or red kernels and still fewer kernels showing the scattered masses of black winter-spore cases.

Kernels Changed by Parasite

The composition of the infected kernels is changed by the parasite feeding upon the stored food substances in the kernels. The stored foods of the kernels are broken down and partly used by the fungus as they are being broken down. The by-products accumulate in the kernel and remain after maturity. As compared with healthy grain, badly scabbed samples have a higher content of fatty acids and of nitrogen soluble in water and ether-alcohol. The starch content is lower, as it has been changed by the fungus to sugar. This results in a higher content of reducing sugar in the infected kernels than in the healthy grains. Likewise the breaking down and use of these stored foods by the fungus result in a higher proportion of hulls and, therefore, a relatively higher crude-fiber content in infected grain.

A similar ear rot of corn is conspicuous in ear corn or shelled corn on account of the pink to red mycelium over the surface or around the embryo end of the kernel. The damage to the corn kernels is essentially similar to that in the infected kernels of the small grains.

Seedling Blight

Seedling blight occurs either when scabbed kernels are used as seed or when poor seed or unadapted varieties are sown in infested soil. The parasite attacks the seedling during and following germination. Blighting frequently occurs before emergence of the seedling, resulting in a poor stand. Other seedlings become blighted after emergence, especially before the plant reaches the tillering stage. The infected parts below ground show a light-brown to reddish brown rot either partially or completely invading the seedling tissues. A similar wide range of symptoms occurs in the seedling blight of wheat, barley, rye, oats, and corn.

Life Story of the Parasite

The life story of the scab parasite is rather complex. As stated previously, the parasite not only grows on various farm-crop plants and produces disease while they are growing, but it also lives on the straw, chaff, and cornstalks after the crop is harvested. It grows commonly on cornstalks and straw left in a moist condition on the surface of the soil, and thus it is carried over winter. The winter spores mature during the spring and are discharged during continued moist weather in the late spring and early summer. If they fall on moist material of almost any kind such as old straw, cornstalks, or manure, they start to grow and soon produce immense numbers of summer spores. The summer spores may also live over the winter on crop refuse. Both the summer and the winter spores are blown to the heads of grain crops, where they grow and infect the young kernel during continued moist weather. Both summer spores and winter spores may be carried over on infected kernels and sown the following season with otherwise good seed.

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Weather Conditions Favoring the Disease

Weather conditions influence the development of both the scab and the seedling-blight phases of the disease. They affect the development of both the crop plants and fungous parasite. The fungus grows best in warm, moist weather.

Warm, rainy weather during the flowering period of the grain crop greatly favors the spread and development of scab. Spores of the parasite formed on old, moist cornstalks on the field are blown to the developing grain heads. Dry weather prevents the germination of these spores and the growth of the parasite, but warm, muggy weather, with heavy dews or quiet rains, furnishes favorable conditions for the germination of the spores and the subsequent infection and growth into the kernel. If these weather conditions prevail widely and extend over a period of time when any of the cereals are flowering or filling, a scab epidemic may spread over an entire area, as in 1919 and 1928, and cause immense losses. It is chiefly on account of variations in these conditions that the destructiveness of scab varies from year to year.

Conditions Favoring Seedling Blight

The seedling blight develops chiefly from the scabbed kernels sown with the seed and from the parasite growing on crop refuse on the surface of the field sown. A warm, comparatively dry soil favors the development of the seedling blight on wheat, rye, and oats. A cold, dry soil favors the development of seedling blight on barley and corn. Stating it conversely, blight does the least damage under conditions favoring the seedling growth of the respective crop plants.

Control Measures

Under the present methods of farming in the Corn Belt, scab is very difficult to control completely. With the present quantities of cornstalks and other crop refuse left on the surface of the field after disking or poor plowing, there is an abundant development of the parasite on this crop refuse. Each year it spreads spores over the grainfields during the summer. All that is necessary, therefore, to start an epidemic, either local or general, is moist, wet weather during or following the flowering period of the grain crops. Obviously, cleaning up the crop refuse or plowing this material under completely, proper crop rotation, and the use of adapted varieties and of high-grade cleaned and treated seed will greatly reduce the losses from this disease. All of these methods are practicable and can be applied under general farm conditions.

Rotations and the Plowing Under of Cornstalks

Investigations conducted during the past eight years have shown that scab is much more severe where small grains are sown on poorly prepared wheatland and cornland. (Table 1.)

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Table 1.-Influence of previous crop upon scab development in wheat and barley

(T = Trace)

State	Season	Scabbed crop	Percentages of scab when crop followed-			
			Corn	Wheat	Oats	Clover
Illinois	1919	Wheat	59	33	33	22
Indiana	1919	do	39	25	16	20
Iowa	1919	do	71	49	30	-
Wisconsin	1919	do	14	-	1	5
Do	1928	do	58	10	2	T
Do	1928	Barley	17	7	2	T

The principal damage done by scab in the northern portion of the Corn Belt has occurred where spring grains were sown on cornland on the surface of which stalks had been left lying. Where large areas of such land are well plowed, as is practiced in the corn-borer clean-up area, small grains can be sown on cornland without great danger of scab losses.

Good Seed, Cleaned and Treated

Seedling blight can be controlled by the proper selection of varieties and treatment of the seed. The varieties best adapted to the district and, if obtainable, seed free from scabbed kernels should be used. If it is necessary to use seed that contains scabbed kernels, the grain should be put through a fanning mill with a heavy wind blast to blow out the scabbed kernels and shriveled grain. After being cleaned, the seed grain should be treated with New Improved "Ceresan" at the rate of one-half ounce per bushel to control the seedling blight. This treatment also controls the barley-stripe disease as well as covered smut and black loose smut of barley. The liquid formaldehyde, liquid copper sulphate, or hot-water treatments are not advisable, as they cause sufficient injury to the seed and seedlings to increase the damage from seedling blight when treated seed is sown in cornland or wheatland infested with the scab parasite. Seed treatment can not make dead seed germinate; therefore good seed should be selected at the beginning. Seed well cleaned, treated with any of the standard commercial mercury dusts, and sown in a well-prepared seed bed should make a good crop, other things being favorable.

Disease-Resistant, Adapted Varieties

Disease-resistant varieties of wheat and barley are being developed at several of the State experiment stations and Government field stations. The standard variety best adapted to the district should be used until the value of new disease-resistant varieties has been fully demonstrated. Scab-resistant spring and winter wheats of good quality are being tried each year in the area affected

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by the disease. Some of these have proved to be rather resistant and of good quality. Among the winter wheats were Turkey selections, Red Rock, and Minturki, and among the spring wheats, Norka, Progress, Resaca, and selections from Illinois No. 1. Illinois No. 1 is fast replacing Marquis wheat in the northern Illinois section, largely because of its resistance to scab. Likewise, Progress wheat is replacing Marquis wheat in Wisconsin and the southern portion of the spring-wheat belt, because of its resistance to scab and rust and because of its higher yields.

The breeding of barley for resistance to scab has not advanced far enough to warrant a definite statement regarding varietal resistance. In general, however, the commercial smooth-awn varieties thus far introduced are more susceptible than the widely grown Manchuria types, including Oderbrucker. Certain selections from smooth-awn crosses have shown resistance to barley scab during the season of 1928 and will be further selected and tested. Hooded varieties are very susceptible to scab and should be avoided where scab occurs abundantly. In general, Manchuria types of barley, including Oderbrucker, selected in and adapted to the district, usually give better yields and suffer less from scab than do newly introduced varieties.

Summary of Control Measures

There are three essential practices for the reduction of losses from scab:

(1) Clean plowing and proper crop rotation.
(2) The use of well-cleaned and treated seed.
(3) The growing of adapted scab-resistant varieties.

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APPLYING RESEARCH TO WILDLIFE CONSERVATION ESSENTIAL TO SUCCESSFUL SOLUTION OF VARIOUS PROBLEMS INVOLVED

EDITOR'S NOTE:- Never before has there been such attention given to wildlife research as at present. Of equal importance is the fact that practical application of the knowledge acquired is being made not only on public lands but also on the private lands of farmers in many localities. Dr. Gabrielson's summary of phases of the work being carried on will be read with interest and profit by those concerned with the conserving of a valuable national resource.

By Ira N. Gabrielson, Chief,
Bureau of Biological Survey,
Washington, D. C.

In recent years there has been a feeling among the leaders in the wildlife conservation movement that the process of conserving species, many of which have been gradually diminishing in numbers, can be speeded up through the application of facts learned through research. The Biological Survey receives annually thousands of requests from landowners and administrators, asking what can be done to make their lands more productive for wildlife. There were many gaps in our knowledge of what to recommend. There are thousands of soil types in the United States, with their intricate vegetative associations and many factors, which include the adaptation of species to environment, climate, diseases, food supply, sufficient breeding and nesting cover, and changes brought on by agricultural practices, forestry, industrial development, and various land uses, as well as misuses. Little need be said about the detrimental effects of drainage, pollution, soil erosion, floods and drought.

With the thought that man can control many of these factors, it seemed expedient to establish research units in the various parts of the country in which these problems exist. Since forestry-wildlife problems are found mainly on large blocks of public lands, the Biological Survey, under the McNary-McSweeney Forest Research Act, established forest biologists at Forest Service Research Stations, located at Portland, Oregon; Berkeley, California; St. Paul, Minnesota; Gulfport, Mississippi; New Haven, Connecticut; and Asheville, North Carolina.

Eleven Wildlife-Research Units

Where the farmer, the private landowner, was concerned, however, the wildlife problems were found most complex. The Biological Survey, looking at the national picture, decided that research stations should be set up on a regional basis,

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covering areas similar in ecological relationships, and because of the closeness to agriculture, that these stations should be located at the land-grant agricultural colleges. On this basis, eleven cooperative wildlife-research units have been set up since 1935, supported financially by the colleges, the State Conservation Departments, the American Wildlife Institute, and the Biological Survey. These research units were organized (1) to seek out new facts on which to base sound wildlife administration, (2) to set up trial demonstration and experimental areas where these facts may be applied, and (3) to give specialized training to graduate students under experienced leadership.

While emphasis is being given to the major species usable by man for sport and recreation, yet we must not lose sight of the fact that considerable attention is being given to all species. The approach to managing any land and water area for wildlife, for the purpose of building up desirable populations, requires (1) a thorough survey of the wildlife, with its food and cover requirements, (2) studies to find out what can be done for improvement, and (3) measures necessary to put such improvements and practices into effect.

As fast as projects are completed, manuscripts are prepared and printed as publications and leaflets of the Federal Department of Agriculture, bulletins of the State Colleges and Agricultural Experiment Stations, the Proceedings of the North American Wildlife Conferences, American Wildlife, Journal of Wildlife Management, Journal of Mammalogy, Ecology, and other current scientific and popular magazines. Reprints and copies are generally available to those interested.

It generally follows that as fast as methods and procedure have been worked out and demonstrated in a practical way, Federal and State game administrators and others having control of wildlife on lands have used the information learned through research in improving the status of the various species. As a nation we are substituting for the old system of trial and error a better one of definite planning for conservation and wise use.

Agricultural News Letter (du Pont)
Vol. 6, No. 10, October, 1938

SEED-BORNE DISEASES AND TESTED CONTROL MEANS INVESTIGATED BY CANADIAN PLANT PATHOLOGISTS

EDITOR'S NOTE:- This article is reprinted from Farm News Letter, Montreal, Quebec, Canada, an information service for editors. This letter is edited by B. Leslie Emslie, C. D. A. (Glas.) F. C. A.

Of late much publicity has been given the remarkable results achieved by Mr. G. A. Scott and his associates in the Division of Botany and Plant Pathology, Ottawa, in the use of organic mercury fungicides for the control of seed-borne diseases of cereals and other crops. That the new improved organic mercury dust will control bunt or smut of wheat, covered smut and stripe of barley and the smuts of oats, practically 100%, is now fairly generally known. But Mr. Scott's investigations have gone further, and he has demonstrated that the same treatment will suppress root and stem rots which menace the well-being of many crops, both by impairing the germinating power of the seed and preventing the normal development of the seedling. On display in Mr. Scott's laboratory are numerous specimens of plants showing the typical symptoms of infection by various diseases, also cultures of germinating seeds, untreated and treated with the new improved fungicide, the untreated covered with masses of disease spores, the treated clean and clear with healthy, robust germination.

Editor Inspects Bayer-Semesan Research Laboratories

With this picture impressed on his mind, Mr. B. Leslie Emslie paid a visit recently to the new research laboratories at Minquadale, near Wilmington, Delaware, where the testing of these organic mercury dusts proceeds. Besides those whose worth is already proven, many other substances possessing fungicidal properties are under observation, and not one is released to the public until it has passed successfully the most exacting tests, usually a process of years. While most of the fungicides are basically organic mercury preparations, their chemical combinations are varied according to the class of plant the seed of which is to be treated.

The building at Minquadale contains laboratory, green-house, work rooms, implement and storage sheds and stands in a 26-acre plot of land which serves for field experiments. A product may remain in the laboratory or greenhouse stage for years before it is considered worthy of trial in the field. At the time of Mr. Emslie's visit in May several acres of peas and four acres of cotton were coming along. It is of interest to note that for cotton seed the ethyl mercury phosphate dust has proved so far the most efficient disinfectant. This is the same substance used, at the rate of one-half ounce per bushel, for the treatment of seed grain in Canada, and one which is becoming increasingly popular with growers of fall wheat in Ontario.

Agricultural News Letter (du Pont)
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INDICATIONS POINT TO URGENT NEED FOR DRAINAGE BECAUSE THE WEATHER MAY BE SHIFTING FROM A DRY TO A WET CYCLE

EDITOR'S NOTE:- The facts set forth here are certain to be of interest to agricultural engineers and others responsible for adequate drainage systems to protect farm lands and growing crops against flooding.

By L. F. Livingston, Manager,
Agricultural Extension Division,
E. I. du Pont de Nemours & Co., Inc.,
Wilmington, Delaware.

From the United States Department of Agriculture comes a report that the weather may be shifting from a dry to a wet cycle. This statement is based on the data gathered since 1886 by the Weather Bureau.

Plentiful rains so far this year, following those of 1937, suggest the possibility that the recent long drought cycle has spent itself and that the years immediately ahead may bring more adequate rainfall to the United States, says J. B. Kincer of the Weather Bureau. He bases his statement on the weather's past performance as recorded by the Bureau.

What The Records Show

The generally dry cycle that lasted from 1930 through 1936, Mr. Kincer points out, was the first extended drought period after the one that lasted from about 1886 through 1895. Following that period of deficient moisture came a series of years -- 1896 through 1909 -- when rainfall was comparatively abundant.

According to the Weather Bureau, "the first half of 1938 was outstanding for its plentiful precipitation. About 80 per cent of the United States had more than normal rainfall. The country as a whole averaged 12 per cent above normal. All the States, except the tier extending from New York to Florida, and Louisiana, North Dakota, and Washington, have had above normal rainfall. The eastern tier of States, comparatively dry till about the middle of July, had abundant to excessive rainfall, with damaging local flood, the latter part of July. The South also had heavy rainfall with more or less local flood damage. This condition -- rare in the weather history of the United States -- and the abundant moisture of last year are in marked contrast with conditions in 1934 and 1936, with their widespread deficiencies in moisture."

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Drainage Systems Neglected

Due to the dry cycle which lasted from 1930 to 1936, most of the outlet ditches, particularly for tile drainage systems, in practically all parts of the United States were neglected to a point where they would no longer remove the water from the tile. During the present year, there were many cases where flooding resulted.

A survey indicates that in 50 per cent of the cases conditions can be remedied more economically by using Ditching Dynamite to remove the accumulated silt, sand and debris than by any other means. Practically every important agricultural state is affected by the present condition of drainage systems. In such States as Indiana with 44.3 per cent of the total land area in drainage enterprises; Illinois 14 per cent, Iowa 17.3 per cent, Minnesota 22.2 per cent, and Ohio with 31.3 per cent, the situation is likely to become acute if the expected wet cycle develops.

One of the important reasons for the use of Ditching Dynamite for drainage improvement is the speed with which the work can be done. Ohio with more than 26,000 miles of main-line drainage ditches and more than double that number of lateral tile drain outlets, presents a problem to engineers if they are to do a job of maintenance in cleaning out these ditches for effective disposal of excess water.

Even in cases where on a cost basis alone some means other than dynamite would be cheaper, the time element often has a bearing on the choice of method.

The amount of work done with dynamite is limited only by the number of men employed in making holes and loading the explosives. Ditches as long as one mile have been loaded and shot in one day. It is a common thing to expect four men to load and blast one-quarter of a mile per day.

Where speed is essential, dynamite is supreme.

SOILLESS GROWTH OF PLANTS - A REVIEW

A new book, Soilless Growth of Plants by Carleton Ellis and Miller W. Swaney, brings within the reach of everyone an understanding of the principles and practices of soilless growth. It was written after the authors had carried out extensive experimentation on the growing of plants, using nutrient solutions and without the aid of soil.

Soilless Growth of Plants contains directions for carrying on plant culture, both in small- and large-scale operations. Here is information on how to build containers and grow flowers and vegetables for the family at small expense. In addition, full directions are given for making up "tested" nutrient solutions from the raw materials needed for growing plants.

The book should be of particular interest to the amateur flower grower or gardener, and the greenhouse operator, as well as the city dweller who grows plants in the home. Its 160 pages are effectively illustrated by more than sixty black-and-white and natural-color photographs of various phases of the growing of plants without soil, and show the various types of equipment.

The volume is bound in PX Cloth, a bookbinding material which may be washed with soap and water. This cloth is not only extremely resistant to wear but is also free from attacks by insects which feed on the starch, glue and other substances used in the manufacture of various book cloths. PX Cloth is a du Pont product.

The publisher of Soilless Growth of Plants is the Book Department of the Reinhold Publishing Corporation, 330 West 42nd Street, New York, N. Y. Price $2.75.

Agricultural News Letter (du Pont)
Vol. 6, No. 10, October, 1938

LEAD TOLERANCE ON FRUITS RAISED TO .025 GRAIN PER POUND BY NEW RULING OF UNITED STATES DEPARTMENT OF AGRICULTURE

EDITOR'S NOTE:- The Department of Agriculture, under date of September 20, authorized the publication of the statement, and the letter by Secretary of Agriculture Wallace which appear here. The importance of this announcement will be recognized by Federal and state agricultural authorities and by farmers and commercial growers of fruits.

Following receipt from the Treasury Department of a statement that investigations by the Public Health Service indicate that the health of consumers will not be endangered by the change, the Secretary of Agriculture has issued notice that the quantity of lead residue permitted on fruits shipped interstate will be raised to 0.025 grain per pound of fruit. The lead tolerance previously enforced under the Food and Drugs Act was 0.018 grain per pound. The tolerances for arsenic and fluorine residue remain unchanged at 0.01 grain per pound.

On September 14 the Treasury Department reported to the Department of Agriculture the findings of the Public Health Service's investigations concluding with the statement:

"...should the Department of Agriculture place the tolerance for lead at 0.025 grain per pound, there is nothing in their (the Public Health Service's) findings to date to suggest that this increase above the present tolerance would be sufficient to endanger the health of the consumer."

On September 19, the Secretary of Agriculture issued a statement giving the Treasury Department's report and concluding as follows:

"In the light of this advice the Department will not institute action under the Food and Drugs Act against fruit containing 0.025 grain per pound of lead, or less."

(NOTE:-The obvious intent of the foregoing quotation is to emphasize the fact that the U.S.D.A. will not institute action under the Food & Drugs Act against fruit carrying a lead residue not exceeding .025 grains of lead per pound of fruit. - Editor, Agricultural News Letter.)

The text of the Secretary's statement follows.

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U. S. DEPARTMENT OF AGRICULTURE
Washington, D. C.

September 19, 1938

TO GROWERS AND SHIPPERS OF APPLES AND PEARS:

On January 26, 1937, this Department announced that the lead tolerance of 0.018 grain per pound would remain in effect until further notice and that the tolerances for arsenic (expressed as arsenic trioxide) and fluorine would in each instance be 0.01 grain per pound.

By the Appropriation Acts for the years ending June 30, 1938 and 1939 the United States Public Health Service was authorized to undertake an investigation to determine the possibly harmful effects on human beings of spray insecticides on fruits and vegetables. This Department has taken the position that it would be guided by the recommendations of the Public Health Service and would liberalize the tolerances if advised by that bureau that this could be done without endangering the health of consumers.

On August 27, 1938, the Treasury Department submitted a document entitled "Progress Report of the Results of a Field Study of the Effects of Inhalation and Ingestion of Lead Arsenate on the Human Body." This report contained no recommendations for changes in existing tolerances. This Department therefore, on September 2, requested that the report be supplemented with a statement of the Public Health Service's views as to whether or not, in the light of the findings so far obtained, a relaxation of the tolerances could now be made without endangering the health of consumers.

This Department is now in receipt of the following communication from the Treasury Department dated September 14:

> "Reference is made to your letter of September 2, 1938, concerning the 'Progress Report of the Results of a Field Study of the Effects of Inhalation and Ingestion of Lead Arsenate on the Human Body', which requests that the Public Health Service supplement this report with a statement as to whether or not, in the light of the findings so far obtained, a relaxation of the tolerance may now be made without endangering the health of consumers of fruit.
>
> "As stated in the above report, this was a progress report of the findings as of June 25, 1938, on the epidemiological field study in the State of Washington. The first publication entitled 'Absorption and Excretion of Lead Arsenate in Man' in connection with the Appropriation Act of 1938 in which the Public Health Service was authorized by Congress

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to determine the possible harmful effects on human beings of spray insecticide on fruits and vegetables was published in the Public Health Reports of July 22, 1938. A copy of this article is attached.

"The findings of this experiment on human beings ingesting a specific amount of lead arsenate have been substantially confirmed by the findings on a larger group of actual consumers at Wenatchee, Washington. As far as can be ascertained from the present study, the consumers examined at Wenatchee had ingested more lead arsenate spray residue than the ordinary consumer, and there is no evidence of untoward effects in these consumers. Results of animal experimentation now in progress are also consistent with these findings on humans.

"It is the understanding of the Public Health Service that the Department of Agriculture has the authority under law to promulgate rules and regulations concerning the contamination of food.

"The findings of the Public Health Service, so far, have failed to reveal evidence of untoward effects on human beings from the ingestion of lead arsenate in excess of present tolerances. Since it is their understanding that the urgency for changing the tolerance to which you refer relates to the tolerance for lead and that the present tolerance for arsenic can be met more easily in practice, should the Department of Agriculture place the tolerance for lead at 0.025 grain per pound, there is nothing in their findings to date to suggest that this increase above the present tolerance would be sufficient to endanger the health of the consumer."

In the light of this advice the Department will not institute action under the Food and Drugs Act against fruit containing 0.025 grain per pound of lead, or less.(*) The tolerances for arsenic and fluorine have not been changed.

Very truly yours,

(signed) H. A. WALLACE,

Secretary.

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* Please refer to note, page 144 -- Ed.